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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* LUKAS TROSMAN, CARY L. KUNZ, RUSSELL E.  
STACHOWSKI, RUSSELL M. FAWCETT, SHINGO FUJIMAKI, and  
DAISUKE GOTO

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Appeal 2007-2607  
Application 10/748,175  
Technology Center 3600

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Decided: March 31, 2008

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Before TERRY J. OWENS, JENNIFER D. BAHR, and  
DAVID B. WALKER, *Administrative Patent Judges*.

WALKER, Administrative Patent Judge.

DECISION ON APPEAL  
STATEMENT OF THE CASE

Appellants seek our review under 35 U.S.C. § 134 of the Examiner's final rejection of claims 21-26 and 28-32. We have jurisdiction under 35 U.S.C. § 6(b) (2002). We affirm.

Appellants claim an apparatus and method for disposing varying length fuel rods in a fuel channel assembly (Specification 1:[0002]). Claim 21, reproduced below, is representative of the subject matter on appeal.

21. A fuel bundle for a boiling water reactor,  
comprising:

a generally square, hollow tube having four  
sides which are configured as sides of the bundle,

a pair of water passages located adjacent to a  
longitudinal centerline of the tube so as to extend  
centrally through the tube, the pair of water  
passages supported by one or more rod supports,

a plurality of fuel rods arranged in a 10 x 10  
or 9 x 9 matrix and including full-length rods and  
part-length rods, the part-length rods further  
comprising:

a first part-length rod group including  
two short-length fuel rod subsets in a mirror-  
image along the centerline between the two  
water passages, each subset further  
comprising three short-length fuel rods in a  
triangular orientation with one rod of the  
subset closer to the longitudinal centerline  
between the two water passages than the  
other two rods, the one rod in direct adjacent  
relation to the other two rods of the subset,  
and

a second part-length rod group  
including four pairs of intermediate-length  
rods, each intermediate-length rod pair  
centrally located in the outermost row or

column of the 10 x 10 or 9 x 9 matrix  
adjacent a corresponding one of the four  
sides of the tube.

### THE REJECTIONS

The Examiner relies upon the following as evidence in support of the rejections:

Ueda	US 5,068,082	Nov. 26, 1991
Johansson	US 5,229,068	Jul. 20, 1993
Orii	US 6,735,267 B2	May 11, 2004

Claims 21-26 and 28-32 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Orii in view of Ueda and Johansson.

### ISSUE

The issue before us is whether Appellants have shown that the Examiner erred in rejecting claims 21-26 and 28-32 under 35 U.S.C. § 103(a) as unpatentable over Orii in view of Ueda and Johansson. The dispositive issue is whether it would have been obvious to one of skill in the art to modify the fuel assembly of Orii with the intermediate and short part-length rods of Ueda as required by the appealed claims in view of the teachings of Johansson of the advantages of using part-length rods.

Rather than repeat the arguments of Appellants and the Examiner, we make reference to the Brief and the Answer for their respective details. Only those arguments actually made by Appellants have been considered in

this decision. Arguments which Appellants could have made but chose not to make in the Brief have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii) (2004).

#### FINDINGS OF FACT

We find the following enumerated findings to be supported by at least a preponderance of the evidence. *Ethicon, Inc. v. Quigg*, 849 F.2d 1422, 1427 (Fed. Cir. 1988) (explaining the general evidentiary standard for proceedings before the Office).

1. There is no dispute that Orie teaches all of the limitations of claim 21, except for differentiating between short- and intermediate-length, part-length rods and including two part-length fuel rod subsets in a mirror-image along the centerline between the two water passages, each subset further comprising three short-length fuel rods in a triangular orientation with one rod of the subset closer to the longitudinal centerline between the two water passages than the other two rods, the one rod in direct adjacent relation to the other two rods of the subset (Answer, 3, Br. *passim*, Reply Br. *passim*).
2. Orie shows a reactor core design in Figure 15 with two part-length fuel rod subsets in a mirror-image along the centerline between the two water passages, but the subsets each comprise two rather than the claimed three part-length rods (Orie, Figure 15). Orie also shows four pairs of part-length rods, each rod pair centrally located

in the outermost row or column of the 10 x 10 matrix adjacent a corresponding one of the four sides of the tube, but does not specify that the rods are of intermediate length (relatively longer than the part-length rods specified in the two subsets adjacent to the water passage described above) (Orii, Figure 15, col. 12, l. 54 – col. 13, l. 39).

3. Ueda teaches sixty –six different embodiments of fuel assemblies for boiling water nuclear reactors, which include varied arrangements of part-length fuel rods in 8 x 8, 9 x 9, 10 x 10, and 11 x 11 fuel rod matrices. For example, Ueda shows using three-rod subgroups adjacent to a water passage (Ueda, Figure 19), and teaches that using four such subgroups around a water passage increases the effective multiplication factor at the high temperature operation period and reduces the effective multiplication factor at the low temperature operation period to provide a large shutdown margin (Ueda, col. 12, ll. 53-66).
4. Ueda teaches the use of two types of part-length rods of different axial length (e.g. short- and intermediate-length rods) and discloses locating the short-length rods at the inner corner portions of subbundles near a water channel and the intermediate-length rods extending outward from a central water channel towards the sides of the tube. The intermediate-length rods are located further

outward from center of the rod assembly than the short-length rods (Ueda, col. 14, l. 41- col. 15, l. 8; Figs. 25A-D).

5. Ueda teaches the use of four single part-length rods, each at the center of a respective side of a 10 x 10 fuel matrix (Ueda, Fig. 27).
6. Johansson teaches numerous advantages resulting from the part-length rod construction, including improved cold shut down margin that enables fuel to be designed with reduced amounts of burnable absorbers, reduced tendency of the fuel bundle in the reactor to produce plutonium at the top of the bundle, and reduced pressure drop in the upper two phase region of the fuel bundle (Johansson, col. 2, ll. 3-15).

### PRINCIPLES OF LAW

“Section 103 forbids issuance of a patent when ‘the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.’” *KSR Int’l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1734 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art, (2) any differences between the claimed subject matter and the prior art, (3) the level of ordinary skill in the art, and (4) where in evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1,

17-18 (1966). *See also KSR*, 127 S.Ct. at 1734 (“While the sequence of these questions might be reordered in any particular case, the [*Graham*] factors continue to define the inquiry that controls.”)

In rejecting claims under 35 U.S.C. § 103(a), the examiner bears the initial burden of establishing a prima facie case of obviousness. *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992). *See also In re Piasecki*, 745 F.2d 1468, 1472 (Fed. Cir. 1984). Only if this initial burden is met does the burden of coming forward with evidence or argument shift to the appellant. *Id.* at 1445. *See also Piasecki*, 745 F.2d at 1472. Obviousness is then determined on the basis of the evidence as a whole and the relative persuasiveness of the arguments. *See Oetiker*, 977 F.2d at 1445; *Piasecki*, 745 F.2d at 1472.

## ANALYSIS

Appellants argue claims 21, 22, 29, and 31 as a group. We consider claim 21 above to be representative.

Appellants argue that Orii, singly or in combination with Ueda, does not teach 1) two short-length fuel rod subsets, each comprising three short-length rods in a triangular orientation with one rod of the subset closer to the longitudinal centerline between the two water passages than the other two rods; 2) a second part-length rod group including four pairs of intermediate-length rods as required by independent claim 21; and 3) a 10 x 10 fuel-rod matrix including full-length, intermediate-length, and short-length fuel rods



as required by claims 21, 29, and 31 (Br. 5-6). The Examiner found that there is no distinction between Orii and the appealed claims except that Orii does not distinguish between short- and intermediate-length rods, and the subsets of rods in a mirror image along the center line are in pairs rather than the triplets required by the appealed claims (Answer 3). We agree (Findings of Fact 1 & 2).

The Examiner relied on Ueda for its teaching 1) to provide 3-rod part-length subsets adjacent to a water passage; and 2) to place relatively shorter part-length rods closer to the center of the fuel bundle and relatively longer part-length rods towards the periphery of the fuel bundle (Answer 4 referring to Ueda, Figures 19 and 25B). The Examiner found that Johansson teaches that the addition of part-length rods lowers the pressure drop, thereby improving critical power, and improves shutdown margin (Answer 4, citing Johansson, col. 2, ll. 3-15).

Appellants further argue that it would not have been obvious and would not have made sense to combine Ueda's 8 x 8 matrix of Figure 19 or 9 x 9 matrix of Figure 25 with Orii's 10 X 10 matrix in Figure 15, because the references have completely different fuel rod arrangements, water passage configurations, and Ueda teaches four sets of short-length rods around each adjacent edge of the water channel. We do not find this argument persuasive because Ueda teaches sixty-six different embodiments of fuel assembly with a variety of configurations of part-length rods in 8 x 8, 9 x 9, 10 x 10, and 11 x 11 fuel rod matrices without limiting its teachings

of the advantages of part-length rods to a particular fuel rod matrix configuration (Finding of Fact 3). Moreover, the Examiner does not seek to bodily incorporate the Figure 19 or Figure 25 embodiments of Ueda into Orii, but rather relies on Ueda only for its teaching 1) to provide 3-rod subsets adjacent to a water passage; and 2) to place relatively short part-length rods closer to the center of the fuel bundle and relatively longer part-length rods towards the periphery of the fuel bundle (Answer 4). Appellant's argument appears to attack Orii and Ueda individually, rather than the combination of Ueda and Johansson with Orii proposed by the Examiner. Nonobviousness cannot be established by attacking the references individually when the rejection is predicated upon a combination of prior art disclosures. *See In re Merck & Co. Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986).

Appellants further argue that there is no teaching, suggestion, or motivation to combine Orii and Ueda based on the differences between the specific embodiments cited by the Examiner. The Appellants assert that the teaching of Johansson that the use of part-length rods lowers pressure drops, and hence may improve critical power would not provide motivation to combine because Orii and Ueda already employ part-length rods (Br. 13).

The Examiner found that the proposed modification of Orii is replacing two full length rods with two part-length rods to convert the two 2-rod subgroups of Orii to the two 3-rod subgroups as shown in Ueda and as required by the appealed claims, which the Examiner found to be within the

purview of the skill artisan and within the teachings of the cited art (Answer 7). The Examiner relied upon Johansson for its teachings of the benefits of part-length rods, particularly improving critical power. The Examiner also found the objects of increasing fuel utilization without increasing pressure loss taught in Orii and maintaining shutdown margin or improving axial power distribution as taught by Ueda to be closely related to each other and to optimizing reactor power.

While there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness, “the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” *KSR*, 127 S.Ct. at 1741.

When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In that instance the fact that a combination was obvious to try might show that it was obvious under § 103.

*Id.* at 1742. In this instance, there are a finite number of identified, predictable possibilities with regard to the arrangement of intermediate- and short-length rods in a reactor fuel assembly. Ueda shows sixty-six such

possibilities (Finding of Fact 3), and the Examiner's proposed combination is nothing more than another identified, predictable solution, combining the elements of Orii and Ueda.

In *KSR*, the Supreme Court emphasized that “[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.” *Id.* The Court explained:

When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill can implement a predictable variation, §103 likely bars its patentability. For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.

*Id.* at 1740. The operative question in this “functional approach” is thus “whether the improvement is more than the predictable use of prior art elements according to their established functions.” *Id.*

In this case, replacing two full length rods with two part-length rods to convert the two 2-rod subgroups of Orii to the two 3-rod subgroups as shown in Ueda and making the two 3-rod subgroups of relatively shorter part-length rods that the four pairs of outer part-length rods as suggested by Ueda is no more than the combination of familiar elements according to

known methods, which is likely to be obvious where, as here, it does no more than yield predictable results. *KSR*, 127 S.Ct. at 1734.

Neither Appellants' Specification nor Appellants' arguments present any evidence that converting the two 2-rod subgroups of Orii to the two 3-rod subgroups as shown in Ueda and making the two 3-rod subgroups of relatively shorter part-length rods that the four pairs of outer part-length rods as suggested by the Examiner would have been uniquely challenging or difficult for one of ordinary skill in the art. Under those circumstances, the Examiner did not err in holding that it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the aforementioned teachings in order to provide the benefits that are the disclosed objects of all of the referenced prior art, particularly an improved shutdown margin (Answer 5). Because this is a case where the improvement is no more than the predictable use of prior art elements according to their established functions, no further analysis was required by the Examiner. *KSR*, 127 S.Ct. at 1740.

The Appellants have failed to show error in the Examiner's rejection of claim 21. Claims 22, 29, and 31 were not argued separately, and fall with claim 21. The Appellants make no arguments as to claims 25 and 28. Claims 25 and 28 therefore fall with claim 21, as they were not argued separately. See 37 C.F.R. § 41.37(c)(1)(vii). *See also In re Young*, 927 F.2d 588, 590 (Fed. Cir. 1991).

The Appellants separately argue the patentability of claims 23, 24, 26, 30, and 32. The Appellants argue that the Examiner has not shown where the lengths of short- and intermediate-length rods relative to the full-length rods as required by claims 23, 24, and 26 is taught (Br. 14). The Examiner found that the number and relative length of part-length rods is a matter of optimization within prior art conditions or through routine experimentation (Answer 5). In particular, the Examiner found that the Appellants have not shown the criticality of the claimed rod length ranges or arrangements, and indeed there is none, as the claimed rod length ranges and number of partial-length rods achieve only predictable and expected changes in reactor performance (Answer 14-15). The Examiner is correct that the Appellants have provided evidence of neither criticality nor unexpected results. The Appellants thus have failed to show error in the Examiner's rejection of claims 23, 24, and 26.

With respect to claim 30, the Appellants argue that the Examiner has not shown where the references teach a 10 x 10 fuel-rod matrix with the claimed arrangement of intermediate length rods. We do not find this persuasive because Orii teaches the claimed arrangement of four-pairs of part-length rods (Finding of Fact 1-2), and Ueda teaches the use of intermediate-length, part-length rods along the sides of a reactor fuel assembly (Finding of Fact 4). As discussed above, we find the Appellants' arguments against the combination of Orii and Ueda unpersuasive; the Appellants have failed to show error in the Examiner's rejection of claim 30.

With respect to claim 32, the Appellants argue that the Examiner has not shown where the references teach a 9 x 9 fuel-rod matrix with six rather than eight intermediate-length rods in a different arrangement (two pairs and two unpaired single rods). The cited references do not explicitly teach this arrangement of intermediate rods, but the Examiner found that the Appellants have not shown the criticality of particular number of part-length rods and that the number of partial-length rods achieve only predictable and expected changes in reactor performance (Answer 14-15). Moreover, Ueda does teach the placement of a single part-length rod at the center of each of the sides of a fuel assembly (Finding of Fact 5).

In this case, replacing two intermediate-length rods with two full length-length rods to convert the two of the pairs of intermediate-length rods taught by Orii into two unpaired intermediate-length rods as shown in Ueda is no more than the combination of familiar elements according to known methods, which is likely to be obvious where, as here, it does no more than yield predictable results. *KSR*, 127 S.Ct. at 1734. Neither Appellants' Specification nor Appellants' arguments present any evidence that converting two of the pairs of intermediate-length rods taught by Orii into two unpaired intermediate-length rods would have been uniquely challenging or difficult for one of ordinary skill in the art. The Appellants have failed to show error in the Examiner's rejection of claim 32.

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### CONCLUSIONS

We conclude that Appellants have not shown that the Examiner erred in rejecting claims 21-26 and 28-32 under 35 U.S.C. § 103(a).

### DECISION

The decision of the Examiner to reject claims 21-26 and 28-32 under 35 U.S.C. § 103(a) is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a). *See* 37 C.F.R. § 1.136(a)(1)(iv) (2006).

### AFFIRMED

vsh

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